Abstracts

Analysis of the numerical dispersion of the 2D alternating-direction implicit FDTD method

The numerical dispersion property of the two-dimensional alternating-direction implicit finite-difference time-domain (2D ADI FDTD) method is studied. First, we notice that the original 2D ADI FDTD method can be divided into two sub-ADI FDTD methods: either the x-directional 2D ADI FDTD method or the y-directional 2D ADI FDTD method; and secondly, the numerical dispersion relations are derived for both the ADI FDTD methods. Finally, the numerical dispersion errors caused by the two ADI FDTD methods are investigated. Numerical results indicate that the numerical dispersion error of the ADI FDTD methods depends highly on the selected time step and the shape and mesh resolution of the unit cell. It is also found that, to ensure the numerical dispersion error within certain accuracy, the maximum time steps allowed to be used in the two ADI FDTD methods are different and they can be numerically determined.

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